millimeters at its center. This design, using a reentrant cylinder, places the end of the mass filter **49** close to small chamber **18** which is the primary source of the ions and still leaves ample space and volume for a high speed pump such as a turbomolecular of other fast pump to be affixed to large pumping port **41**. The mass-to-charge analyzer **49** and the ion detector **48** are mounted on the right of the separating wall (as seen in the figure) which is in a region of high vacuum, normally at a pressure of less than 10^{-5} torr, produced by a fast vacuum pump connected to a large pumping port **42** to evacuate the third chamber **46**. The actual area of aperture **45** is determined by the speeds of the vacuum pumps used and the pressure desired in chamber **46**, in which the mass-to-charge analyzer is located, and is readily determined from well known formulas on gas flow.

In this differentially pumped version of the invention, the planar lenses **36** focus the ions into aperture **45**, rather than directly into the mass-to-charge analyzer, from whence they proceed into mass-to-charge analyzer **49**. In this embodiment, because the mass-to-charge analyzer is not in second chamber **31** where the jet free expansion from the small chamber occurs, the pressure in the second chamber may be increased to more than 10^{-4} torr and this greater absolute pressure permits the pinhole aperture **35** in the small chamber to be larger, which is a convenience from the point of view of reducing the susceptibility of the pinhole aperture **35** to plug up.

Otherwise, the apparatus of FIG. **2** operates similarly to that of FIG. **1**.

FIG. **3** shows two modifications to the small chamber, the first modification being one in which a gas such as nitrogen or argon or any other selected gas is additionally admitted to small chamber **18** to ensure that the pressure in the small chamber is near-atmospheric pressure or above atmospheric pressure as desired in the event that vaporization of the liquid droplets is insufficient to maintain the pressure desired. In this case the gas from a reservoir **61** passes through a controlled leak value **62** and thence via a tube **63** which is inserted through the insulating plug **15** into the small chamber. Tube **63**, passing into small chamber **18** may optionally pass through metallic wall **16** instead of insulating plug **15**.

FIG. **3** also shows a valve **72** which may be mounted directly on small chamber **18**. This valve may optionally be a relief valve set to ensure that the pressure in the small chamber does not exceed a desired amount and, in this usage, a tube **73** vents directly into the atmosphere. When pressure in small chamber **18** is less than atmospheric pressure, tube **73** can be connected to a vacuum pump.

FIG. **4** illustrates a further modification of small chamber **18** wherein a heater coil **71** which is mounted inside the small chamber between hollow metal cylinder **27** and outer wall **16** of the small chamber **18**. Heater coil **71** provides additional heat, as required, to evaporate the droplets when the carrier liquid is not highly volatile. The electric current for the coil, which may be made of tungsten, platinum, tantalum, nichrome or any other standard heater wire material, is produced from a voltage source V_H which connects to one end of heater coil **71** through a vacuum feedthrough **75**. The other end of heater coil **71** is connected to metallic wall at a contact **16***a* of small chamber **18** which, in the interests of personnel safety, is normally at ground potential. Other methods of providing heat to the gas in small chamber **18** may be employed including generally heating the entire small chamber from the outside by means of electrical heating tape, by infrared irradiation, or other conventional means.

It will be appreciated that the three modifications illustrated in FIGS. **3** and **4**, and their variants, may be used either individually or in combination of any two, or in combination of all three.

FIGS. **5A** through **5E** are five details on various shapings of the end of the capillary tube **20**. FIG. **5A** shows the end ground off at a slant in the manner of hypodermic needles. This design results in a high electric field in the vicinity of the resulting sharp edge point **81** and accomplishes the electrospray of the carrier liquid using relativey low voltages V_1. FIG. **5B** shows an end which has been ground so that cylindrical symmetry is maintained while retaining a sharp edge **82** for development of high fields while using relatively low voltage V_1. FIG. **5C** illustrated an end of tube **20** wherein an alternate method of grinding same has been employed leaving a sharp annular edge **85** where high electric fields are developed using relatively low voltages V_1. The geometry of FIG. **5C** is preferred where it is desired that the size of the electrosprayed droplets be small, whereas the geometry of FIG. **5B** is preferred if slightly larger initial droplets are desired.

FIG. D shows a geometry where the annular end **86** is ground flat with the plane of grinding being prependicular to the axis of the capillary tube. This geometry is preferred for ease of manufacture, although to produce the high fields required for electrospray higher potentials V_1 are required. FIG. **5E** shows a configuration where the capillary tube is cut off as in FIG. **5D** but where thereafter the edge of the annular end **87** is rounded. This geometry is preferred where high voltages V_1 are intentionally desired or where it is desired to have a fairly strong electric field extending throughout the small chamber for purposes of minimizing the time that a droplet remains in the small chamber, i.e., in cases where the carrier liquid is highly volatile and where one wishes the chemical ionization processes in the small chamber to operate for as short a time as possible.

Electrical circuit for element **38**, focusing components mesh **47** and lens **36** and electron sources **51** have not been specifically illustrated as being understood within the skill of the art.

Although the preferred embodiments of the invention are described herein, it is to be understood that the inventive concepts are capable of other adaptations and modifications within the scope of the appended claims which should therefore be construed to cover not only the corresponding structure, material or acts described in the specification but also equivalents thereof.

Having thus described my invention, what I claim as new and desire to secure by Letters of the United States is:

1. A method of obtaining a mass spectrometric analysis of the constituents of liquids wherein electrically charged droplets of the liquid are formed by an electrospray process, the method comprising the step of producing said droplets by causing the liquid to be analyzed to flow through a capillary tube of small bore which is placed at a high electrical potential whereby said droplets emerge from said tube in an electrically charged condition in a small chamber maintaining the pressure of the gas therein sufficiently high effectively